IMAPS Advanced Technology Workshop on

Thermal Management

DINAH'S GARDEN HOTEL
PALO ALTO, CA 94306
OCTOBER 23 - 26, 2005

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Program Committee:

Cullen Bash, Hewlett-Packard Laboratories
Herman Chu, Cisco Systems
Vadim Gektin, Sun Microsystems
Bill Maltz, Electronics Cooling Solutions
George Meyer, Peninsula Components
John Peeples, The Citadel
Guy Wagner, RM Laboratories and Cornice, Inc.

Sponsored by:
The International Microelectronics And Packaging Society (IMAPS)
"Everything in electronics between the chip and the system"

in conjunction with the Packaging & Assembly of Power LEDs ATW • October 25-28*
*Visit www.imaps.org/leds for more information!

Early-Bird Registration Ends: October 10, 2005
Hotel Cut-off: October 10, 2005

Sunday, October 23

Registration: 6:00 pm – 8:00 pm

Opening Reception: 7:00 pm – 8:00 pm

Monday, October 24

Registration: 7:30 am – 9:00 pm

Continental Breakfast: 7:30 am – 8:30 am

Session 1: Market Drivers

8:30 am - 10:00 am

Chair: Dave Saums, DS&A LLC

Minimizing the Burdened Cost of Power: A Key Market Driver of the Future Information Technology Industry
Chandrakant D. Patel, Amip Shah, Hewlett-Packard Laboratories

Mobile Thermal Challenges in Future Platforms
Rajiv Mongia, Intel Corporation

TIM Material Testing in Practice and Future Directions
Dave Saums, Robert A. Rauch, DS&A LLC; Cameron Murray, 3M Company; Marta Rencz, Micred; Clemens Lasance, Philips

Break: 10:00 am – 10:30 am

Session 2: Thermal Interface Testing

10:30 am - 12:30 pm

Chair: Vadim Gektin, Sun Microsystems

TIM2 Engineering Qualification Guidelines
Stanley Pecavar, Don Kearns, Margaret Stern, John Dunn, Vadim Gektin, Brett Ong, Tony Chen, Sun Microsystems

Performance Evaluation of Advanced Thermal Materials
Margaret B. Stern, Don Kearns, Robert Melanson, Gawtam Jhoty, Vadim Gektin, Stan Pecavar, Sun Microsystems

➔A Thermal Interface Material Characterization Test Apparatus
Ni Zhou, Fred Barez, San Jose State University

➔Design and Verification of an Apparatus for Thermal Resistance and Conductivity Measurements for a Thermal Interface Material
Kaustubh Kalkundri, Frank Andros, Bahgat Sammakia, State University of New York at Binghamton

Lunch: 12:30 pm - 1:30 pm

Session 3: Data Center Cooling

1:30 pm - 3:30 pm

Chair: Cullen Bash, Hewlett-Packard Laboratories

Dynamic Thermal Management of Air Cooled Data Centers
Cullen Bash, Chandrakant Patel, Ratnesh Sharma, Hewlett-Packard Laboratories

Hotspots in Data Centers: 3-Dimensional Thermal Measurements
Hendrik F. Hamann, James Lacey, Martin O'Boyle, Roger Schmidt, Mahdusudan Iyengar, IBM T.J. Watson Research Center

Partial Cold-Aisle Isolation for Raised-Floor Data Centers
James W. VanGilder, American Power Conversion

Vision of the Data Center Cooling Roadmap into the Future
Steven Madara, Emerson Network Power / Liebert

Break: 3:30 pm – 4:00 pm

Session 4: System Level Cooling

4:00 pm - 6:00 pm

Chair: Herman Chu, Cisco Systems

Air and Liquid Cooling Solutions for Orthogonal Card Packaging Architectures
Andreas C. Pfahnl, Chris Heard, Teradyne Inc.

High Performance Liquid Cooled Hybrid Composite Enclosures
James C. Calder, Material Innovations Inc.

Composite Enclosure for High Power Avionics
Roland Watts, Amanda Colleary, Mark Kistner, AFRL Materials and Manufacturing Directive

Heat Sink Thermal Performance in Next Generation RF Amplifiers
Nader Nikfar, George Meyer, Powerwave Technologies, Inc.

Reception: 6:00 pm - 6:30 pm
Dinner: 6:30 pm – 7:30 pm

Session 5: Organic Thermal Interfaces

7:30 pm - 9:00pm

Chair: Vadim Gektin, Sun Microsystems

Carbon Nanofibers for Thermal Interface Materials in Pressure Contacts
Ernst Hammel, Xinhe Tang, Markus Trampert, Juergen Schulz - Harder, Michael Haberkorn, Andreas Meyer, Electrovac GmbH

High-Conductivity Adhesives for Power Device Packaging
Alan Grieve, M. Albert Capote, Arsenia Soriano, Aguila Technologies, Inc.

Reliability and Performance of Thermally Conductive Adhesives
Brian J. Toleno, James J. Earle, Henkel Corporation

Tuesday, October 25

Registration: 7:30 am – 9:00 pm

Continental Breakfast: 7:30 am – 8:30 am

Session 6: Testing and Modeling

8:30 am - 10:00 am

Chair: Guy Wagner, RM Laboratories and Cornice, Inc.

Analytical Thermal Stress Modeling in Physical Design for Reliability of Micro- and Opto-Electronic Systems: Role, Attributes, Challenges, Results
Ephraim Suhir, University of California at Santa Cruz and Nanoconduction, Inc.

Identification of Thermocouple Error as a Function of Mounting Technique
Guy R. Wagner, RM Laboratories

➔Influence of Thermal Contact Resistance on Thermal Impedance of Microelectronic Structures
Bjorn Vermeersch, Gilbert De Mey, University of Ghent

Break: 10:00 am – 10:30 am

Session 7: Metallic Thermal Interfaces

10:30 am - 12:30 pm

Chair: Bill Maltz, Electronics Cooling Solutions

Metal TIMs for High Power Cooling Applications
Bruce K. Furman, P. A. Lauro, D. Y. Shih, T. Van Kessel, Y. Martin, E. G. Colgan, W. Zou, S. Iruvanti, J. Wakil, R. Schmidt, M. K. Iyengar, IBM

Semiconductor to Copper Bonding by Microwave Selective Heating Technology
Nasser Budraa, Boon Ng, Microwave Bonding Instruments

Microprocessor Performance and Reliability Utilizing a Phase Change Metallic Alloy Thermal Interface System
Chris G. Macris, Enerdyne Solutions

Solder Die Attach using Active Solder Materials
Randall Redd, Ronald Smith, S-Bond Technologies LLC

Lunch: 12:30 pm - 1:30 pm

Session 8A: Liquid Cooling

1:30 pm - 3:30 pm

Chair: George Meyer, Peninsula Components

Next Generation Technologies in Two Phase Cooling
Scott D. Garner, Chanwoo Park, Advanced Cooling Technologies

Next Generation Spray Cooling: Compact, High-performance and Reliable
Timothy A. Shedd, University of Wisconsin-Madison

Indirect Thermosyphon Technology using 3M Fluorinated Heat Transfer
Phillip E. Tuma, 3M Company

Computer CPU Two Phase Cooling
Nagui Mankaruse, Delta Engineers

Break: 3:30 pm – 4:00 pm

Session 8B: Liquid Cooling

4:00 pm - 6:00 pm

Chair: George Meyer, Peninsula Components

Second Generation Porous Metal Cold Plate Technology for Single-Phase Liquid Cooling
Kevin L. Wert, C. Scott Schaeffer, Thermacore International, Inc.

Performance of Foamed Graphite in Cold Plates, Heat Pipes, and Heat Sinks
Ronald Smith, Randall Redd, Lee Weichmann, Materials Resources International

➔FC-72 Spray in Electronics Cooling: A Numerical Tool to Study the Heat Transfer between a Microdroplet and a Solid Surface
Rajneesh Bhardwaj, Daniel Attinger, State University of New York at Stony Brook

➔Theoretical Modeling of Gravity Influence on Oscillating Heat Pipe
Shibin Liang, University of Missouri-Columbia and Sun Microsystems

Reception: 6:00 pm - 6:30 pm
Dinner: 6:30 pm – 7:30 pm

➔Student Competition Winners
sponsored by
DS&A LLC
Electronics Cooling Solutions
Hewlett-Packard Laboratories

Session 9A: High Conductivity Composites

7:30 pm - 9:00 pm

Chair: Dave Saums, DS&A LLC

Composite Heat Spreaders for High Power Package Cooling
Sushumna Iruvanti, Amilcar Arvelo, Hilton Toy, Gregory Martin, Garry Benarr, Kamal Sikka, IBM

Manufacture of High Thermal Conductivity (+700W/mK) Cu-Graphite Composites with Reaction Bonded Carbide Formation to Improve Wetting
Glenn Sundberg, Nirupama Kattamuri, University of Massachusetts at Lowell

Development of CTE Matched High Conductivity Discontinuous Graphite Fiber Reinforced Cu: The Role of Melt Chemistry and Fiber Architecture
James A. Cornie, Eugene Chen, Shiyu Zhang, Metal Matrix Cast Composites, LLC

Wednesday, October 26

Registration: 7:30 am – 12:30 pm

Continental Breakfast: 7:30 am – 8:30 am

Session 9B: High Conductivity Composites

8:30 am - 10:00 am

Chair: Dave Saums, DS&A LLC

Implementation of Diamond Pins as Thermal Vias for High Heat Flux Spreading in CTE-Compatible Lids and Substrates for Semiconductor Packaging
David L. Saums, DS&A LLC; Jerry Zimmer, sp3 Diamond Technologies Inc.; Kevin P. Fennessy, CPS Technologies Inc.

High Thermal Dissipation Upcoming Materials for Microelectronics Packaging
Juan L. Sepulveda, Intertec Advanced Materials; Lee Vardermark, Brush Ceramic Products

Affordable CTE Modified Carbon Composites for Thermal Management Applications
Wei Shih, J. D. Hwang, Allcomp Inc.

Break: 10:00 am – 10:30 am

Session 10: Thermoelectric Coolers

10:30 am - 12:00 pm

Chair: John Peeples, The Citadel

Embedded Thermoelectric Devices for Hot-Spot and other High-Flux Cooling Applications
David A. Koester, Robert Conner, Nextreme Thermal Solutions, Inc.

Chip Design Methodology for Thermal Optimization
Dave Rosato, Dave Koester, Marco Soto, Bob Conner, Harvard Thermal

➔Is ZT the Main Performance Factor for Hot Spot Cooling using 3D Microrefrigerators?
Yan Zhang, Gehong Zeng, Ali Shakouri, University of California, Santa Cruz; Avram Bar-Cohen, University of Maryland

Workshop Closing and Discussion: 12:00 pm - 12:15 pm

Lunch: 12:15 pm - 1:15 pm

IMAPS Advance Technology Workshop on
Packaging & Assembly of Power LEDs
Dinah's Garden Hotel
Palo Alto, CA
October 25 - 28, 2005
www.imaps.org/leds

Registration Form

Register On-Line at www.imaps.org/thermal

Thermal Management ATW: October 23 - 26, 2005

❑ Dr. ❑ Mr. ❑ Ms. Member ID# ________________

First Name________________________________M.I.____________Last Name_______________________________

Company/Affiliation____Job Position___________________________

Address____

City__________________________ State______ Zip___________ Country___________________________________

Phone________________________ Fax_________________________ Email____________________________________

Registration Fees: Early-Bird Registration Ends 10/10/05

Thermal Workshop Fees

	(On or before **10/10**)	(After **10/10**)
❑ Member (IMAPS)	$615	$715
❑ Non-member*	$715	$815
*Includes one-year individual membership in IMAPS		
❑ Speaker/Chair/Student	$350	$450

Workshop Fees include an Abstract Book; all meals listed and a CD of Presentations. CD of Presentations will be mailed 10 business days after the event.

Thermal & LEDs (*Register for both ATWs and Save*)

❑ Member (IMAPS)	$1180	$1380
❑ Non-member*	$1380	$1580
*Includes one-year individual membership in IMAPS		
❑ Speaker/Chair/Student	$650	$850

Additional Purchases

❑ Spouse/Guest *(meals only)*	$160	$160
❑ CD of Presentations *(Member Rate)*	$150	$150
❑ CD of Presentations *(Non-Member Rate)*	$275	$275
❑ Add to Ship in the US	$7	$7
❑ Add to Ship Overseas	$25	$25

How did you hear about this event?

❑ Direct Mail ❑ Website ❑ E-Mail
❑ Advancing Microelectronics ❑ Colleague
❑ IMAPS Weekly E-mail Bulletin ❑ Personal Phone Call
❑ Industry/Trade Magazine ❑ Other________________

Housing *(Hotel Cut-off is October 10, 2005)*

Housing Accommodations **must** be made directly to:

Dinah's Garden Hotel
4261 El Camino Real
Palo Alto, CA 94306
P: 650-493-2844 or 800-227-8220

Room Rate: $125

Please reference IMAPS when making reservations.

Dinah's Garden Hotel requires a deposit for the first night's room and tax to hold your room. Deposit refunded if reservation is cancelled fourteen (14) days prior to arrival.

Two Workshops - One Location
Register for both ATWs and Save!

Thermal Management: October 23-26, 2005
www.imaps.org/thermal

LEDs (Light Emitting Diodes): October 25-28, 2005
www.imaps.org/leds

Payment

THERMAL05PROG

Thermal Workshop Fees: $_______________

Thermal & LEDs: $_______________

Additional Purchases: $_______________

Total Payment Due: $_______________

A $25 fee must be added to all Wire Transfers.

❑ Enclosed is a check payable in US funds to IMAPS

❑ Charge my fees to:

❑ Visa ❑ MasterCard ❑ Discover ❑ Amex ❑ Diners Club

Card#________________________________Exp.__________

Signature____

Card billing address, if different from above: (required)

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Mail this form with payment to: IMAPS * 611 2nd Street, NE * Washington, DC 20002-4909. For credit card transactions, register on-line: www.imaps.org; or register by phone with your credit card by calling 202-548-4001; Fax: 202-548-6115. Additional information? E-mail: IMAPS@imaps.org, or visit our web site: http://www.imaps.org. Cancellations will be refunded (less a $50 processing fee) only if written notice is postmarked on or before **Friday, October 14, 2005**. No refunds will be issued after that date.

IMAPS Registration
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Washington, DC 20002-4909

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